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THE WHITE ANT.

(*Termes flavipes* Koll.).

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No insect occurring in houses is capable of doing greater damage than the one under consideration. Its injuries are often hidden until the damage is beyond repair, and as it affects the integrity of the building itself as well as its contents, the importance of the insect becomes very evident. Fortunately it is not often present in the North in houses,

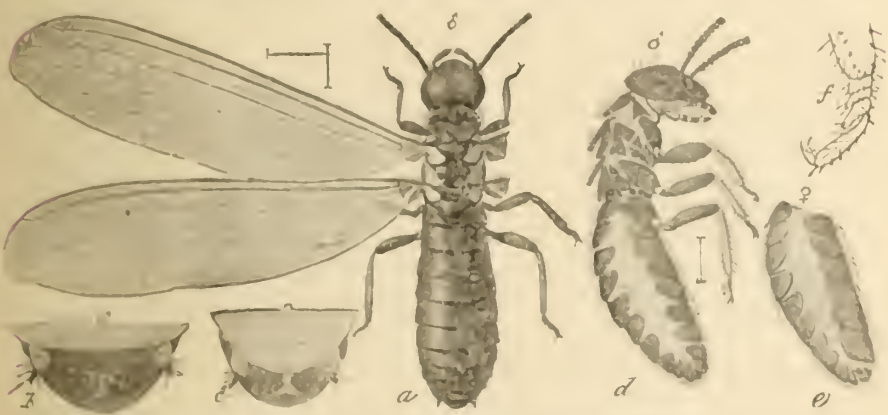

FIG. 1.—*Termes flavipes*: *a*, Adult male; *b*, terminal abdominal segments of same from below; *c*, same of female; *d*, male, side view, somewhat inflated by treatment with ammonia; *e*, abdomen of female, side view; *f*, tarsus, showing joints and claw; *a*, *d*, *e*, enlarged; *b*, *c*, *f*, greatly enlarged (original).

but as the Tropics are approached the injuries from it in dwellings or other structures of wood are of common experience and often of the most serious nature, causing the sudden crumbling of bridges and wharves and settling of floors or buildings.

The term "white ant," by which this insect is universally known, is entirely inappropriate in so far as it indicates any relationship with the true ants. Strictly speaking, the white ant is not an ant, but a neuropteroid insect belonging to the order Isoptera and is allied to the book lice and stone flies. The only analogy with ants is in superficial resemblance and in the social habits of the two groups, in which great similarity exists. The popular acquaintance with the termite or white ant is mainly derived from witnessing its nuptial spring flight, when the small brown, ant-like creatures with long glistening white wings emerge from cracks in the ground or from crevices in buildings, swarming out sometimes in enormous numbers, so that they may often be swept up

by the quart. These winged individuals are not the ones which do the damage, but are the colonizing form. The real depredators are soft-bodied, large-headed, milky white insects, less than a quarter of an inch in length, which may often be found in numbers under rotting boards or in decaying stumps. These last are the workers and soldiers (fig. 4, *c* and *d*), and constitute the bulk of the colony for most of the year, the winged migrating forms, consisting of the sexed individuals, appearing normally only once a year, usually in April or early in May.

The white ants present, in an entirely distinct order of insects, another of those most curious problems of communal societies which find so many examples among the ants, bees, and wasps. A colony of white ants includes workers, soldiers, the young of the various forms, and, at the proper season of the year, the winged males and females; also a single parent pair, the specially developed king and queen. In the case of the common white ant of this country (*Termes flavipes*), the fully developed queen or mother of the colony, swollen to great size by her enormous ovary development, and her consort, the fully developed but much smaller king or male, have never been found in the white ant communities, and this in spite of the great numbers of the flying stage of both sexes that appear every spring. The soldiers or workers are degraded or undeveloped individuals of both sexes, differing in this respect from ants and bees, in which the workers are all undeveloped females.

The economy of the termites is almost exactly analogous to that of the ants and bees. The workers attend to all the duties of the colony, make the excavations, build the nests, care for the young, and protect and minister to the wants of the queen or mother ant. In this they are assisted somewhat by the soldiers, whose duty, however, is also protective, their enormous development of head and jaws indicating their rôle as the fighters or defenders of the colony. Both the workers and soldiers are blind. The colonizing individuals differ from the others in being fully developed sexually and in the possession of very long wings, which normally lie flat over each other, the upper wings concealing the lower and both projecting beyond the abdomen. These wings have a very peculiar suture near the base, where they can be readily broken off, leaving mere stumps. At the time of the spring flight the winged individuals emerge from the colony very rapidly, frequently swarming in clouds out of doors, and after a short flight fall to the ground and very soon succeed in breaking off their long clumsy wings at the suture referred to. In this swarming or nuptial flight they come out in pairs, and under favorable conditions each pair might become especially developed, as described above, and establish a new colony, but in point of fact this probably rarely happens. They are weak flyers, clumsy, and not capable of extensive locomotion on foot, and are promptly preyed upon and destroyed by many insectivorous animals, so that rarely indeed do any of the individuals escape.

Theoretically, if one of these pairs succeeded in finding a decaying stump or other suitable location at hand, they would enter it, and the king and queen, being both active, would attend to the wants of the new colony and superintend the rearing of the first brood of workers and soldiers, which would then assume the laborious duties of the young colony. Thereafter the queen, being constantly and liberally fed and kept absolutely inactive, would increase immensely, her abdomen becoming many hundred times its original size. She would practically lose the power of locomotion and become a mere egg-laying machine of enormous capacity. Allied species whose habits have been studied in this particular indicate an egg-laying rate of 60 per minute, or something like 80,000 per day.

In the absence of a queen, however, white ants are able to develop from a very young larva or nymph of what would otherwise become a winged female what is known as a supplementary queen, which is never winged and never leaves the colony. This supplementary queen

FIG. 2.—*Termes flavipes*: *a*, Head of winged female viewed from above; *b*, same from below, with mouth parts opened out. (Greatly enlarged; original)

(fig. 4, *a*), for the discovery of which we are indebted to the late H. G. Hubbard, is smaller than the perfect sexed queen, but subserves all the needs of the colony in the matter of egg laying, and is the only parent insect so far found in the nests of the common white ant in this country. Whether a true queen exists or not is, therefore, open to question; if not, all the individuals which escape in the spring and summer migrations must perish, and this swarming would, therefore, have to be considered a mere survival of a once useful feature in the economy of this insect, now no longer, or rarely, of service.

The normal method of the formation of new colonies is probably by the mere division or splitting up of old ones—their galleries and branch colonies extending great distances from the home colony—or through the carrying of infested logs or timbers from one point to another.

These curious insects have a very simple development. There is scarcely any metamorphosis, the change from the young larva to the adult being very gradual and without any marked difference in structure. They feed on decaying wood or vegetable matter of any sort, and are able to carry their excavations into any timbers which are

moistened, or into furniture, books, or papers stored in rooms which are at all moist. Their food is the finely divided material into which they bore, and from which they seem able to extract a certain amount of nourishment, probably from the molds and ferments generated in the moistened vegetable substance, since they redevour the same material several times. Bearing out this theory, tropical species are known to grow mushroom beds artificially on the product of which they largely subsist. The white ants are also somewhat cannibalistic, and will devour the superfluous members of the colony without compunction, and they normally consume all dead individuals, cast skins, and other refuse material. They are capable also of exuding a sort of nectar, which is used to feed the young and the royal pair, and which they also generously give to one another.

All except the migrating winged forms are incapable of enduring full sunlight, and the soft, delicate bodies of the workers, soldiers, and young rapidly shrivel when exposed. In all their operations, therefore, they carefully conceal themselves, and in their mining of timbers or books and papers the surface is always left intact; whenever it is necessary for them to extend their colonies it is done only under the protection of covered runways, which they construct of particles of comminuted wood or little pellets of excrement. In this way the damage which they are doing is often entirely hidden, and not until furniture breaks down or the underpinning and timbers of houses or floors yield is the injury recognized. The swarming of winged individuals in the early summer, if in or about houses, is an indication of their injurious presence and warrants an immediate investigation to prevent serious damage later on.

The common termite of America is very widespread, occurring from the Atlantic to the Pacific and from Canada southward to the Gulf. It has been found on the mountains of Colorado and Washington at a height of over 7,000 feet. In prairie regions it may often be seen during the swarming season issuing from the ground at frequent intervals over large pasture tracts, where it must feed on the roots of grass and other herbage. It has also been carried to other countries and is a common and often very injurious enemy of buildings and libraries in Europe. A closely allied and equally injurious European species (*Termes lucifugus*) has also been brought to this country in exchange for ours, but compared with our own species it is somewhat rare though already widely distributed. In this country serious damage to buildings from the white ant has not been of common occurrence, especially in the North, except in some notable instances. In Europe our species has caused greater damage, and some years ago gained access to one of the Imperial hothouses at Vienna, and in spite of all efforts to save the building it was necessary ultimately to tear it down and replace it with an iron structure. In this country instances are on record of very serious damage to books and papers. An accumulation of books and

papers belonging to the State of Illinois was thoroughly ruined by their attacks. A school library in South Carolina, which had been left closed for the summer, was found on being opened in the autumn to be completely eaten out and rendered valueless. In the Department of Agriculture an accumulation of records and documents stored in a vault not perfectly dry, and allowed to remain undisturbed for several years, on examination proved to be thoroughly mined and ruined by white ants. Humboldt, on the authority of Hagen, accounts for the rarity of old books in New Spain by the frequency of the destructive work of these insects.

Numerous instances of damage to underpinning of buildings and to timbers are also on record. The flooring of one of the largest sections of the United States National Museum was for some years annually undermined and weakened by a very large colony of these pests which could not be located, and finally the authorities solved the problem by replacing the wood floor with one of cement. A few years ago it was found necessary to tear down and rebuild three frame buildings in Washington in consequence of the work of this insidious foe, and renewal of foundation timbers or replacing with artificial stone is often called for.

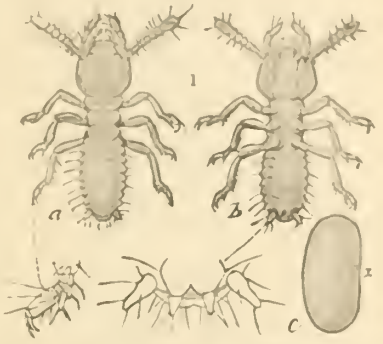

FIG. 3.—*Termes flavipes:* *a*, Newly hatched larva; *b*, same from below; *c*, egg. All enlarged (original).

Damage of the sort mentioned has occurred as far north as Boston, but, as stated, greatly increases as one approaches the Tropics, where the warmth and moisture are especially suited to the development and multiplication of this insect. There houses and furniture are never safe from attack. The sudden crumbling into masses of dust of chairs, desks, or other furniture, and the mining and destruction of collections of books and papers, are matters of common experience, very little hint of the damage being given by a surface inspection, even when the interior of timbers or boards has been thoroughly eaten out, leaving a mere shell.

While confining their work almost solely to moistened or decaying timbers or vegetable material of any sort, and books and papers that are somewhat moist, termites are known to work also in living trees, carrying their mines through the moist and nearly dead heartwood. In this way some valuable trees in Boston were so injured as to make their removal necessary. In Florida these insects have been the cause of considerable damage to newly planted groves of orange trees, working around the crowns and in the roots. The damage has been chiefly noted in recent clearings where a good deal of rotten wood still remained in the soil, this accounting for their presence. These insects are some-

times also the occasion of considerable injury to other trees; and quite recently the writer received information of injurious attacks on pecan, chestnut, and walnut trees at Augusta, Ga. They also cause loss in conservatories, attacking cuttings and the roots of plants. Such injuries have been brought to our notice several times by florists, and Mr. Chittenden, of this office, informs me that white ants are apt to attack the large stems of herbaceous plants like geraniums. In greenhouses the termites usually originate in the more or less decayed woodwork of the building itself or the plant benches, and they have even been found

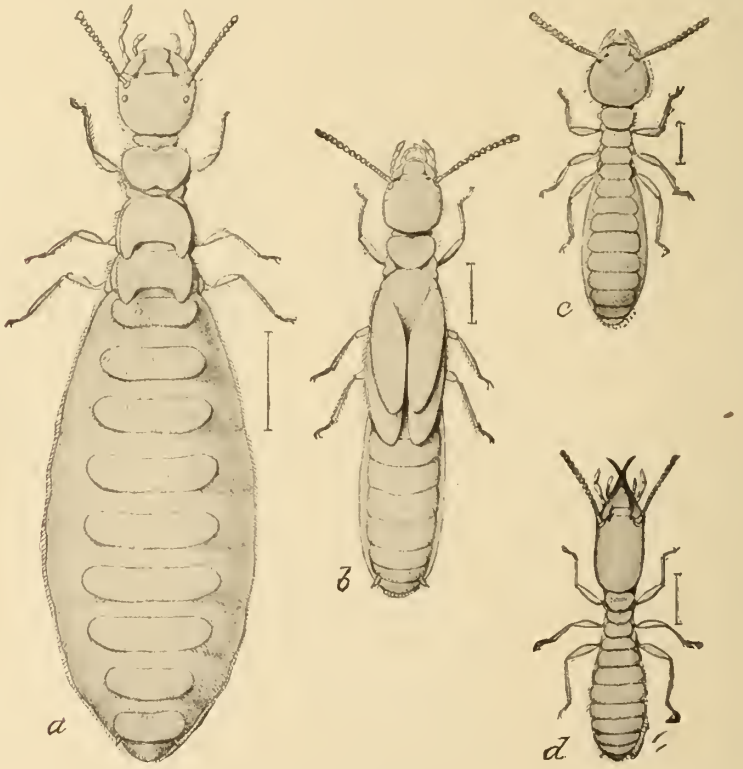

FIG. 4.—*Termes flavipes: a*, Queen; *b*, nymph of winged female; *c*, worker; *d*, soldier. All enlarged (original).

working in label sticks, the removal of which gave relief from the damage done to plants. In one instance, also, the termites, coming from the wooden benches, entered potted plants through the drain hole of the pots. In prairie regions their work is necessarily on the roots and tubers of plants or the stems of grasses or other low-growing plants.

A very common form of injury to potatoes growing in rich soil or where there is a considerable quantity of decaying vegetable matter has often been noted, and the cause for it has been obscure or assigned to insects innocent of the damage. That the white ant is the culprit in this case was discovered by Mr. F. A. Marlatt, who describes the injury

to the tubers as having the form of scars or pits covering the surface, the pits varying in shape from irregular holes to long, irregular excavations sometimes extending far into the potato, but commonly to a depth of from an eighth to a fourth of an inch. In all cases these pits are more or less overhung and covered by the dead and dying skin, and are also lined with the cellular tissue of potato, showing that the insect cares most for the starch and water of the tuber. Such damage may occur not only in soil rich in vegetable matter but also in newly cleared soil or soil containing the loose and decayed portions of trees, and in the instance cited above was in soil from which an old apple orchard had recently been cleared.

PREVENTIVES.

White ant infestation of houses is probably always from an outside source. The queen chamber and breeding center of the colony may be and usually is remote from the building, but the workers construct minute galleries or tunnels through the ground and go long distances in search of moist and decaying wood. Their entrance to buildings is gained through some of these soil channels by way of wooden beams or joists sunk in concrete in the foundations of the buildings, or the supports of porches or other parts of the edifice which come in contact with the soil. The fact that the beams or joists of the basement are entirely inclosed or imbedded in concrete is only a partial protection. In the settling of the house concrete is almost sure to crack, allowing avenues of ingress, and the beams and joists put down in the moist material soon partially decay and become exceptionally good breeding places; from such beams the white ants carry their burrows up through the timbers to the first and even second floors. To be on the safe side, therefore, the foundations of buildings should be entirely of brick, stone, or concrete, including the basement floor, and especially should this method of construction be followed in tropical and subtropical regions.

In the case of old buildings not constructed in this way considerable protection can be gained by surrounding them with clear spaces and graveled or asphalted walks, and looking after the prompt removal of any decaying stumps or partially rotted posts that may be in adjacent grounds. Complete dryness is an important means of rendering buildings safe from attack. Books and valuable documents should not be packed away in unventilated chambers where they may become moist and moldy, and are then particularly subject to attack by white ants, which are very likely to be present in old buildings even though their work has not been sufficient to bring them into special notice.

Impregnation with creosote renders wood comparatively immune from the attacks of white ants, and in regions where injury is to be anticipated it would be well to use wood so treated wherever it comes in contact with the ground. A heavy coating of foundation timbers with tar is often resorted to, and this protects the wood as long as the

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coating is intact. Certain woods, also, are fairly immune, and of these the redwood of California is most accessible and seems to have a good record. Capt. Geo. P. Ahearn, U. S. Army, reports that California redwood has been used for more than twenty-five years in the Philippines, and has never been known to be injured by white ants. Its use in Manila is very general, especially for the construction of cabinets, filing cases, etc., where it is desirable to protect valuable papers from these insects.

In the Tropics household furniture, such as stands and bureaus, not in daily use can be protected by placing the legs in small vessels containing oil. Furniture, furthermore, should not lean against or touch walls, especially in houses of wood, and frequent examinations should be made of libraries and of stored papers.

REMEDIES.

The presence of flying termites in a building at any time in the spring or summer should be followed immediately by a prompt investigation to determine the extent of the infestation and the possibilities of further damage. The point of emergence of winged individuals may approximately, though not always, indicate the location of the infested timbers, and if these can be replaced injury may be checked, or, under favorable circumstances, stopped. In some cases thorough and repeated drenching of infested timbers, where accessible, with kerosene or some other petroleum oil will afford relief, but probably will not stop entirely the work of the termites, which, as indicated under the heading of "Preventives," are constantly recruited from some central colony probably distant from the building. The destruction of winged individuals as they emerge is of no value whatever. Where the injury is confined to books and papers or exposed woodwork and furniture, hydrocyanic-acid gas fumigation is to be recommended, exposing if possible also, by opening up floors, the infested joists beneath, and spreading out the books and opening cases and wardrobes. For description of the use of hydrocyanic-acid gas see Circular No. 46 of this series. It is very rarely possible to find and destroy the external colony, and if the remedies noted are not feasible or prove ineffective there is no other course but to replace the foundation of the buildings with walls and floorings of stone, concrete, or other form of rock composition. In the case of the National Museum building in Washington and several private edifices this course was finally adopted, with the result that white ants were completely excluded and their work terminated.

Approved:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *December 30, 1907.*

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